



LITHIUM-ION BATTERIES: HAZARDS & BEST PRACTICES

Lithium-ion (Li-ion) and lithium polymer (LiPo) batteries have been the cause of several high-profile fires and many routine fires across the nation. Let's review the hazards these batteries present in public buildings and offer best practices to protect people and property.

Hazards

Lithium-ion batteries are used in e-mobility devices, consumer electronics, power tools, electric vehicles, and energy storage systems (ESS). They have a higher energy density, lower maintenance, higher performance, and better longevity than traditional lead acid or nickel-based batteries.

Lithium-ion batteries are generally safe when used properly. Typical failures are caused by mechanical abuse, temperature abuse, extended charging times, incompatible chargers, and substandard or defective manufacturing.

Lithium-ion battery packs of any scale can off-gas when they fail. A failure of an e-mobility device containing a lithium-ion battery pack in a garage can lead to deflagration. This low-speed explosion produces about 3 psi of pressure inside the garage. That pressure will exert approximately 50,000 pounds of force on a garage door and potentially turn the door into a large projectile. Energy storage systems containing lithium-ion batteries can be as large as a shipping container. If these batteries fail, there is a significant possibility of deflagration.

Best Practices Against Fire



- Purchase electronics, tools, and batteries from reputable suppliers and manufacturers. Look for UL labels.
- Purchasers should read all instructions and guides supplied with the batteries. If employees will use the equipment, train them on the instructions.

- Avoid excessively hot and humid conditions, especially when batteries are fully charged. Do not place batteries in direct sunlight, hot surfaces, or hot locations.
- Always inspect batteries for any signs of damage before use. Never use and promptly dispose of damaged or puffy batteries.
- Immediately disconnect the batteries if, during operation or charging, they emit an unusual smell, develop heat, change shape/geometry, or behave abnormally.
- Exercise caution with new products and cheap knock-offs built without adherence to safety standards.

Best Practices when Charging

- The Li-ion battery packs found in portable laptops and similar devices usually require no user input for charging other than connecting it to the charging cable if from a reputable manufacturer. They contain a Battery Management System (BMS) in the battery pack that controls the charging process. Be sure to use the manufacturer's AC adapter.
- Never leave a battery pack unobserved during charging. Always stay in or around the charging location to periodically check for any signs of battery or charger distress. Occasionally check on output levels and balancing effectiveness.

- For series battery packs, always balance the charge with a charger capable of monitoring the condition of individual cells to prevent individual cells from being overcharged. The charger and battery should be on a heat-resistant, nonflammable, nonconductive surface. Fire-safe containers designed for Li-ion batteries are available. Never place them on a car seat, carpet, or similar surface. A best practice is to charge and store batteries in a fire-retardant container like a Lipo Sack.
- Keep all flammable materials away from the operating area.
- Do not overcharge batteries. Do not leave batteries connected to chargers after charging is complete.

Best Practices for Use and Storage

Proper lithium-ion battery storage is critical for maintaining optimum battery performance and reducing the fire and explosion risk. Following are some best practices that, if correctly followed, will reduce the risk of fire and explosion of stored batteries.

- Whenever a battery is not used actively (e.g., for more than 3 days), it should be placed in the storage area to avoid being damaged and unsafe. Remove the lithium-ion battery from a device before storing it.
- Store batteries in a dry and well-ventilated place at room temperature or lower. Do not store batteries in a refrigerator, as this may create internal condensation when the battery is brought to room temperature, which can become dangerous when operated.
- It is best to have a reserved area ONLY for lithium-ion battery storage. It must be a cool and dry place, away from heat sources. Batteries can be stored in a metal cabinet, such as a chemical storage cabinet. Make sure that the batteries are not touching each other. Using a lithium-ion battery fireproof safety bag or other fireproof container is a good practice when storing batteries.
- Lithium-ion cells should not be stored fully charged. Many chargers have a “storage mode” to charge or discharge the cell to the proper storage voltage. Experts recommend putting the cells in storage mode after every run. This will help the battery to lengthen the usable life span.

Several high-profile fires involving Li-ion batteries have occurred in public housing ([April 10, 2023, NYC](#), [March 14, 2023, CT](#), [January 9, 2022, NYC](#)). New York City is considering banning e-bikes and scooters in public housing. Other options being considered are [banning second-use or refurbished batteries or creating dedicated stations](#) for charging and storing e-bikes and scooters.

U.S. Department of Housing and Urban Development issued a memorandum suggesting their managers educate their residents and post flyers on lithium-ion recharging best practices.

